Interactive
Media
Systems

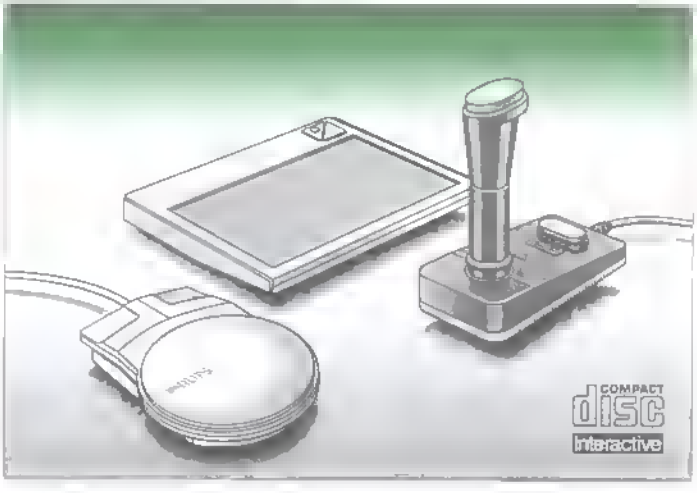
CD-I

Date August 1990

TECHNICAL INFO

Philips Consumer Electronics B.V., Interactive Media Systems

Technical Info
Pointing Devices



The reason for this specification.

Pointing devices play a significant part in CD-I systems. The CD-I standard (Green Book) lays down only very general requirements other than to classify pointing devices. Clearly, it is in the interest of all CD-I developers to assure that pointing devices and CD-I players from any manufacturer be both plug compatible and interface compatible, except in special cases where the pointing device is either built in or dedicated to the player system.

There is a need for a *de facto* standard for pointing devices. Thus, Philips Interactive Media Systems has produced this specification in consultation with other leading player and device manufacturers.
This specification is intended to guide all CD-I product manufacturers, who are urged to give it their full support.

The benefits of this specification.

For the CD-I player manufacturer, this specification offers the prospect of an installed base of compatible pointing devices and simplified sourcing. The input device manufacturer can look forward to an installed base of compatible CD-I players, lower costs for new device development, complete interface specifications, and no software interface problems.
For dealers, there will be fewer stock risks and increased demand.
Consumers can be offered products with good availability, reasonable prices, and a variety of choices.

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More info at http://www.icdia.org/

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INTRODUCTION

This specification defines the interface for CD-I pointing devices for connection to a general CD-I pointing device port.
The interface is specified so that the CD-I player can recognize the device type. Device characteristics are dependent on the device type.

DEFINITIONS AND GENERIC TERMS

The classification of pointing devices used in this specification is based on Appendix VII.2, paragraph 2.5.1.1. of the Green Book. The classifications follow below.

ABSOLUTE SCREEN POINTING DEVICES

Pointing devices used directly on the screen include light pens and touch screens. The screen position given by the pointer is tied to the location on the display screen.
Examples: light pens, touch screens.

ABSOLUTE COORDINATE POINTING DEVICES

Pointing devices that deliver absolute coordinate positions for the screen pointer include graphics tablets and absolute coordinate mice.
These devices output the absolute position of the pen in relationship to the grid and its resolution.
Examples: graphics tablets, absolute coordinate mice.

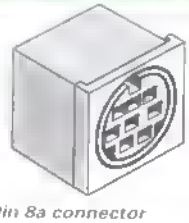
RELATIVE COORDINATE POINTING DEVICES

Pointing devices that deliver relative coordinate positions for the screen pointer include mouse and trackball devices. These devices provide output with incremental or decremental values for both x and y coordinates, relative to the last read out.
Examples: mice, trackballs.

MANEUVERING POINTING DEVICES

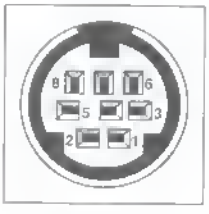
Pointing devices that deliver control information to maneuver the screen pointer to its desired position include joysticks and joypads. The output from these devices specifies the direction in which the cursor is to be moved with a fixed or variable (optional) velocity. At least sixteen directions, equally spaced around a 360 degree area, must be available to the pointing device.
Examples: joysticks, joypads.

CONNECTOR



Mini Din 8a connector

Mini Din 8a pinning



8 pins mini-DIN Hosiden TCP 8500 series 8a type (e.g. TCP 8580-01-010) or compatible plug on the device (male), with mating TCS 7500 series or compatible socket on the CD-I player.

The miniature circular connector's fitting dimension of 9mm is far smaller than the conventional DIN or D-sub type connector.

The miniature circular connector is approximately one fourth the volume of the equivalent DIN connector and is both visually attractive and space saving.

Specifying this connector ensures:

- Regular availability
- Free sourcing of cable assemblies
- Free choice of plug (straight, angle or even screw lock)
- Free choice of sockets (unshielded, shielded, installation hole switched, chassis mounted)

RATINGS:

- +5V output from the CD-I player
  - accuracy +5V 10%
  - supply current 50mA
- RxD
  - logical 1 -15V < signal level < +0.8V
  - logical 0 +2.4V < signal level < +15V (Output impedance pointing device max 4.7kOhm)

Connector pinning

Pin		Pin signal	In/Output
1	TxD	Not connected	
2	RxD	Received data	Input*
3		Reserved	
4		Reserved	
5	GND	Signal ground	
6		Reserved	
7	RTS	Request to send	Output*
8	+5V	Power supply for the device	

*Input: an input signal to the CD-I player. Output: an output signal from the CD-I player.

Note: Some CD-I players may supply up to 200mA on the +5V power supply line. Input devices requiring over 50mA should have a provision for an external power supply.

- RTS
  - Off (Negated) -15V < signal level < +0.8V
  - On (Asserted) +2.4V < signal level < +15V

DATA SIGNALS

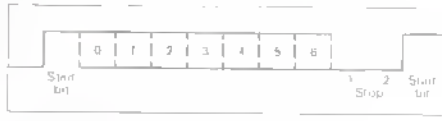
Communications should use the RS-232-C interface. For details of this see the EIA RS-232-C standard.

Signalling rate: 1200 or 9600 bauds.

Data format:

- 1 start bit
- 7 data bits LSB first
- 2 stop bits

Data Format



Signal Name Convention

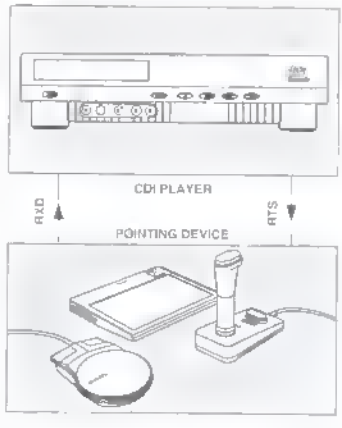
For pointing devices only two signal lines carry data.

The first is RTS, which is always output from the CD-I player. The second is RXD, which is always input to the CD-I player.

RxD: Carries the data from pointing device to player.

RTS: Used for device identification (see Device Identification).

Signal Flow



DEVICE IDENTIFICATION

Every pointing device should transmit its type identification (ID) byte on request. This allows the CD-I player to identify the device type and the transmission speed of the pointing device that is connected to it. This guarantees maximum flexibility and ease of use.

Device ID sequence

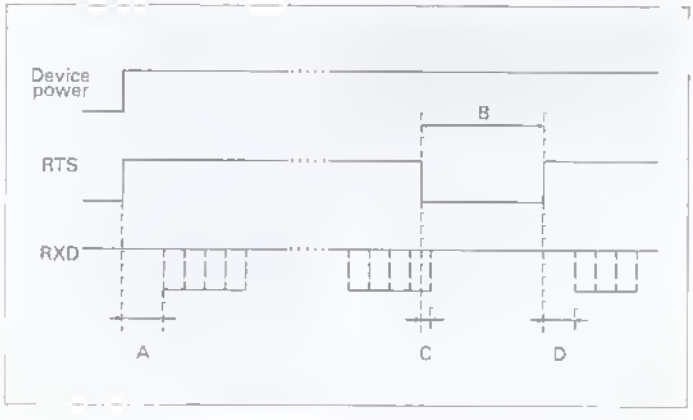
1. Negate RTS. Current data transmission to the CD-I player is stopped.
2. Assert RTS.
3. The device sends its 1-byte device ID.

Device ID codes

Device type	d6	d0	ASCII
Relative	[illegible]		M
Mechanical	[illegible]		J
Absolute	[illegible]		I
Absolute Screen	[illegible]		S

Note: It is advisable to send a complete data packet after the identification byte to establish the state of the buttons at startup.

Timing Chart and Legend



Device ID timing

A device power-on to ID byte timing
Min 100ms
Max 500ms

B negate RTS timing
Min 10ms
Max irrelevant

C Residual data transmission time when RTS is negated
Min 0ms
Max 1 byte period (1200 baud = 8.3ms, 9600 baud = 1ms)

D Assert RTS to ID byte timing when device is powered
Max 10ms

RELATIVE COORDINATE DEVICES

e.g. Mice, Trackballs.

Data Flow

During normal operation
(RTS asserted):

- Data is sent to the CD-I player via RXD.
- Every time the device is moved or button state is changed, 3-byte data packets should be transmitted to the player.
- No data should be transmitted when the device is stationary (in center position) and the button state is unchanged (pressed or released).
- A button state change or device position change should not interrupt a data packet transmission.
- To allow for additional buttons on the pointing device, one additional byte (with d6 = 0) may be added to the data package at the discretion of the manufacturer. Systems specified to work with the specific device will react to this byte; other systems will ignore it.

Data Format

Signalling rate: 1200 or 9600 bauds

	d6	d5	d4	d3	d2	d1	d0
Byte 0	1	bt1	bt2	Y7	Y6	X7	X6
Byte 1	0	X5	X4	X3	X2	X1	X0
Byte 2	0	Y5	Y4	Y3	Y2	Y1	Y0

bt 1 = button 1: 1 = pressed, 0 = not pressed

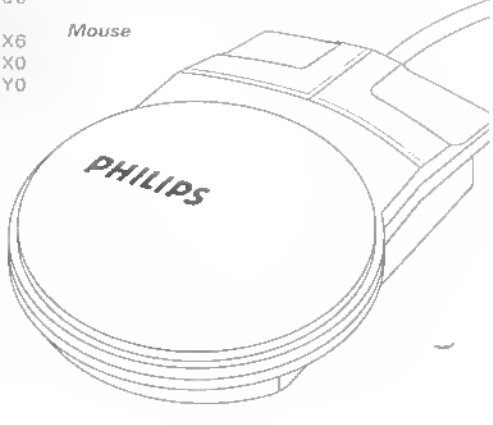
bt 2 = button 2: 1 = pressed, 0 = not pressed

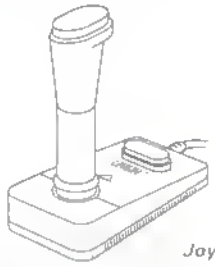
X7 X0: 8-bit data horizontal movement, 2's complement, left direction = negative ($FF $80), right direction = positive ($01 $7F)

Y7 Y0: 8-bit data vertical movement, 2's complement, up direction = negative ($FF $80), down direction = positive ($01 $7F)

A value of $00 for horizontal or vertical movement indicates no movement in that direction.

Mouse





Joystick

MANEUVERING DEVICES

e.g. Joysticks and Joypads

Joysticks and joy pads are devices with identical functions although they are physically different

Data flow
During normal operation (RTS asserted)
- Data is sent to the CD-I player via RXD
- Three-byte data packets should be sent continuously to the CD I player when the device is moved out of center position
- A 3-byte data packet should be sent to the CD-I player every time a button changes state
- No data should be transmitted when the device is stationary (in center position) and the button state is unchanged (pressed or released)
- A button state change or device position change should not interrupt a data packet transmission
- To allow for additional buttons on the pointing device, one additional byte (with d6 =0) may be added to the data package at the discretion of the manufacturer. Systems specified to work with the specific device will react to this byte, other systems will ignore it

See Remarks Maneuvering Devices

Data Format
Signalling rate: 1200 or 9600 bauds

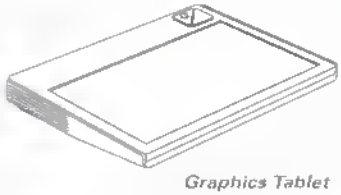
	d6	d5	d4	d3	d2	d1	d0
Byte 0	1	bt1	bt2	Y7	Y6	X7	X6
Byte 1	0	X5	X4	X3	X2	X1	X0
Byte 2	0	Y5	Y4	Y3	Y2	Y1	Y0

bt 1 = button 1: 1 = pressed
0 = not pressed
bt 2 = button 2: 1 = pressed
0 = not pressed
X7 - X0: 8-bit data horizontal movement
2's complement
up direction = negative ($FF - $80)
down direction = positive ($01 - $7F)
Y7 - Y0: 8-bit data vertical movement
2's complement
up direction = negative ($FF - $80)
down direction = positive ($01 - $7F)
A value of $00 for horizontal or vertical movement indicates no movement in that direction

ABSOLUTE COORDINATE DEVICES

e.g. Graphics Tablets, Light Pens.

Data Flow
During normal operation (RTS asserted)
- Data is sent to the CD-I player via RXD
- Four-byte data packets should be sent continuously to the CD I player when the pointing indicator, e.g., light pen, is in motion on the tablet's active area
- No data should be transmitted when the pointing indicator is not in the active area and the button state is unchanged (pressed or released)
- A 4-byte data packet should be sent to the CD-I player every time a button changes state (button 1, button 2 or pen down)
- A button state change or pointing indicator position change should not interrupt a data packet transmission
- To allow for additional buttons on the pointing device, one additional byte (with d6 =0) may be added to the data package at the discretion of the manufacturer. Systems specified to work with the specific device will react to this byte, other systems will ignore it



Graphics Tablet

Data Format
Signalling rate: 1200 or 9600 bauds

	d6	d5	d4	d3	d2	d1	d0
Byte 0	1	bt1	bt2	X9	X8	X7	X6
Byte 1	0	pd	0	Y9	Y8	Y7	X6
Byte 2	0	X5	X4	X3	X2	X1	X0
Byte 3	0	Y5	Y4	Y3	Y2	Y1	Y0

bt 1 = button 1: 1 = pressed
0 = not pressed
bt 2 = button 2: 1 = pressed
0 = not pressed
pd = pen down
1 = pointing indicator on active area
0 = pointing indicator not on active area
X9 - X0: 10-bit absolute horizontal position
outermost left position: $000
outermost right position: $3FF
Y9 - Y0: 10-bit absolute vertical position
outermost upper position: $000
outermost lower position: $3FF

ABSOLUTE SCREEN DEVICES

e.g. Touch Screens, Light Pens.

Data Flow

During normal operation (RTS asserted)

- Data is sent to the CD-I player via RxD
- Four byte data packets should be sent continuously to the CD-I player when the pointing indicator, e.g. finger or light pen, is in motion on the screen's active area
- No data should be transmitted when the pointing indicator is not in the active area and the button state is unchanged (pressed or released)
- A 4 byte data packet should be sent to the CD-I player every time a button changes state (button 1, button 2, pen down, or change of finger pressure)
- A button state change or pointing indicator position change should not interrupt a data packet transmission
- To allow for additional buttons on the pointing device, one additional byte (with d6 =0) may be added to the data package at the discretion of the manufacturer. Systems specified to work with the specific device will react to this byte, other systems will ignore it

Data Format

Signalling rate: 1200 or 9600 bauds

	d6	d5	d4	d3	d2	d1	d0
Byte 0	1	b11	b12	X9	X8	X7	X6
Byte 1	0	pd	0	Y9	Y8	Y7	X6
Byte 2	0	X5	X4	X3	X2	X1	X0
Byte 3	0	Y5	Y4	Y3	Y2	Y1	Y0

b1 1 = button 1: 1 = pressed
0 = not pressed

b1 2 = button 2: 1 = pressed
0 = not pressed

pd = pen down
1 = pointing indicator on active area
0 = pointing indicator not on active area

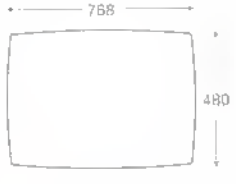
X9 - X0: 10-bit absolute horizontal position
outermost left position: $000
outermost right position: $3FF

Y8 - Y0: 10-bit absolute vertical position
outermost upper position: $000
outermost lower position: $3FF

REMARKS
Maneuvering Devices

Green Book Specifications

- The pointing device must make available at least 16 different directions equally spaced around a full 360 degree area. (Green Book, Appendix VII 2-17.1)
- A pointing device must be able to point to every pixel on a normal resolution screen. The PT_coord coordinates are in high resolution.



High Resolution Screen Pixel Density-525 line mode

Parameters

- Data rate: at 1200 bauds the maximum possible data rate from a joystick to a CD-I player is 1 byte every 8.3 ms. A complete data packet (4 bytes) takes 3*8.3=25 ms. The maximum data rate is then 40 packets per second.
- Pixels in X and Y: high resolution = 678x480 (525 line mode)
- Cursor speed: General formula = D = NP/SP*DR

D: Data value at maximum speed
NP: Number of pixels
SP: Cursor speed (in seconds)
DR: Data rate (in data packets per second)

Analog and Digital Devices

The following examples indicate some factors to consider when developing analog or digital maneuvering devices.

ANALOG Type

- The data value transmitted at maximum X and/or Y deflection to represent maximum speed depends on the time allowed for the cursor to cross the screen (see the Cursor Speed formula above). If, for example, the time chosen is 1 second, the value required is approximately $13 (768/1 x 40).
- The center position should give a value of $00.
- The remaining data values ($01 to $12) should be spread over the deflection angle.

DIGITAL Type

- The maximum data value can be derived in the same way as for the analog type.
- It should be possible to pinpoint every pixel on the screen. When the stick is in the first position (from center), the X and/or Y data sent should be +1 or -1 to give the slowest speed.
- For a three-speed device, the value for the midpoint deflection should be midway between the maximum value and zero. This results in medium speed. The following values result when the maximum traverse speed is 768 pixels per second.
Positive: $01, $09, and $12
Negative: $FF, $F7, and $EE
- For devices with more or less than three speeds, intermediate values can be interpolated.

Note: Compared with relative coordinate devices, the MS bits of the X and Y data bytes are less meaningful for maneuvring. However, the data packet format is kept the same.

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